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<b>(21) International Application Number:</b> PCT/GB92/00782 <b>(22) International Filing Date:</b> 28 April 1992 (28.04.92) <b>(30) Priority data:</b> 9109536.4 2 May 1991 (02.05.91) GB <b>(71)(72) Applicant and Inventor:</b> BOWERS, Frank [GB/GB]; P.O. Box 1, Hoby, Melton Mowbray, Leicestershire LE14 3DT (GB). <b>(74) Agent:</b> LAWRENCE, John, Gordon; McNeight & Lawrence, Regent House, Heaton Lane, Stockport SK4 1BS (GB). <b>(81) Designated States:</b> AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, RU, SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US.		<b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> POLYMERIC COMPOSITIONS  <b>(57) Abstract</b>  There is disclosed a method of producing a porous composite comprising the steps of : pre-wetting particulate material with a liquid curing agent medium to form a stable intermediate; transporting the intermediate to site; forming a shaped mass of the intermediate; and applying to the intermediate a liquid polymer or pre-polymer, either immediately before or after formation of said mass.		

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POLYMERIC COMPOSITIONS

This invention concerns methods and materials for the production of polymeric compositions, particularly, though by no means exclusively, suitable for use in the formation of impact absorbing surfaces or substrates to sports or play areas.

Known such impact absorbing surfaces comprise crumbs of a natural or synthetic rubber, such as EPDM for example, in a matrix of polymer, such as polyurethane for example.

The matrix may completely fill the spaces between the crumbs to give a non-porous composition or may simply coat the surfaces of the crumbs to cause them to adhere leaving the interstices between the crumbs void to give a porous product.

Either kind of composition may be laid to form a sports or play surface or to form a substrate to another surface such as that provided by synthetic turf for example.

The compositions are prepared on site immediately before use by mixing crumb, liquid polymer and if necessary a catalyst, to enable them to be laid, in the manner of asphalt, before polymerization has advanced

sufficiently to render them unworkable. Advantageously polymerization times are short to reduce the risk of damage to the finished surface before it has set.

The on site preparation and short setting time necessitates expensive equipment and highly trained operators regardless of the size of the project.

It is an object of the present invention to provide a method and materials for production of a porous composite which overcomes the disadvantage aforesaid.

According to the present invention there is provided a method of producing a porous composite comprising the steps of :-

pre-wetting particulate material with a liquid curing agent medium to form a stable intermediate;

transporting the intermediate to site;

forming a shaped mass of the intermediate; and

applying to the intermediate a liquid polymer or pre-polymer, either immediately before or after formation of said mass.

The shaped mass may be a horizontal layer.

The liquid polymer or pre-polymer may be in the form of an emulsion.

The liquid polymer or pre-polymer may include an inhibitor or retarder to give extended shelf life.

The liquid medium may contain a catalyst or a chemical to neutralise any inhibitor or retardant present in the liquid polymer or pre-polymer.

The liquid medium may contain a coupling agent.

The liquid medium may contain a diluent.

The particulate material may be a natural or synthetic rubber crumb.

The intermediate may be mixed with the liquid polymer or pre-polymer for a predetermined short period before formation of the shaped mass.

The mixing may be effected using a conventional cement mixer.

The liquid polymer or pre-polymer may be applied to the shaped mass by spraying or pouring.

The invention also includes compositions for use in practising the methods aforesaid.

The invention will be further apparent from the following description, which concerns, by way of example only, the laying of a running-track in accordance with one method thereof.

In general the invention comprises pre-wetting a rubber crumb with a curing agent to form a stable intermediate, at a central facility. The intermediate is bagged for storage and transport to site.

Onto a suitable sub-base a base coat comprising the intermediate is laid using conventional concrete or asphalt laying techniques and equipment.

An emulsion of polymer or pre-polymer is then sprayed over the crumb surface so as to pass through the interstices of the mix to join the crumbs into a coherent mass. Excess liquid disperses into the sub-base.

In an alternative approach the intermediate is mixed with the polymer or pre-polymer for a predetermined short time using a conventional cement mixer to initiate polymerisation before the mix is laid.

In a specific example SBR waste rubber granules having sizes in the range of 2mm - 6mm are coated with 2% by weight of a liquid medium comprising a hydraulically stable organic polyol containing the polyurethane catalyst dibutyltin mercaptide and a coupling agent (silane). The mixture is bagged for storage and use at a later date. The shelf life of the bagged mixture is greater than 12 months.

A Diphenylmethane -4, 4' Di-Isocyanate based pre-polymer having a free (-NCO) of between 8.5% and 9.5% with a viscosity of between 2800 and 3400 cp is prepared and bottled. The shelf life of pre-polymer is up to 12 months.

When required the bags of pre-wetted rubber granules and bottles of pre-polymer are transported to site.

The pre-wetted granules and pre-polymer are mixed (1 litre of pre-polymer to 40 kg of granules) by tumbling in a conventional cement mixer for between three and five minutes.

The final mixture is then laid onto a prepared sub-base and allowed to polymerise.



Polymerisation time is controlled by adjusting the amount of catalyst pre-mixed with the rubber granules.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

Whilst the specific example is concerned with a polyurethane resin system it will be understood that other systems such as epoxy resin systems might be used.

Again, for example, the particulate material may comprise cork crumb, gravel, chipped bark or any other material suited to the intended application.

Yet again, for example, the composition may include fillers, colouring materials or other known additives.

CLAIMS

1. A method of producing a porous composite comprising the steps of :-

pre-wetting particulate material with a liquid curing agent medium to form a stable intermediate;  
transporting the intermediate to site;  
forming a shaped mass of the intermediate; and  
applying to the intermediate a liquid polymer or pre-polymer, either immediately before or after formation of said mass.

2. A method according to claim 1, wherein the shaped mass is a horizontal layer.
3. A method according to claim 1 or claim 2, wherein the liquid polymer or pre-polymer is in the form of an emulsion.
4. A method according to claim 3, wherein the liquid polymer or pre-polymer includes an inhibitor or retarder to give extended shelf life.
5. A method according to any preceding claim, wherein the liquid medium contains a catalyst or a

chemical to neutralise any inhibitor or retarder present in the liquid polymer or pre-polymer.

6. A method according to any preceding claim, wherein the liquid medium contains a coupling agent.

7. A method according to any preceding claim wherein the liquid medium contains a diluent.

8. A method according to any preceding claim, wherein the particulate material is a natural or synthetic rubber crumb.

9. A method according to any preceding claim, wherein the intermediate is mixed with the liquid polymer or pre-polymer for a predetermined short period before formation of the shaped mass.

10. A method according to claim 9, wherein the mixing is effected using a conventional cement mixer.

11. A method according to any one of claims 1-8 wherein the liquid polymer or pre-polymer is applied to the shaped mass by spraying or pouring.

12. A method according to any preceding claim, wherein the polymer or pre-polymer is a polyurethane based on Diphenylmethane -4, 4' Di-Isocyanate.

13. Bags of pre-wetted particles and containers of polymer or pre-polymer suitable for use in the method of any of claims 1-12.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/00782

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC5: C 08 J 9/00, 3/00, E 01 C 13/00</b>														
<b>II. FIELDS SEARCHED</b> <div style="text-align: right; margin-right: 100px;">Minimum Documentation Searched<sup>7</sup></div> <table style="width: 100%; border: none;"> <tr> <td style="width: 20%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">IPC5</td> <td style="border: 1px solid black; padding: 5px;">C 08 J; E 01 C</td> </tr> </table> <div style="text-align: center; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in Fields Searched<sup>8</sup></div>			Classification System	Classification Symbols	IPC5	C 08 J; E 01 C								
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 60%;">Citation of Document,<sup>11</sup> with indication, where appropriate, of the relevant passages<sup>12</sup></th> <th style="width: 30%;">Relevant to Claim No.<sup>13</sup></th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">P,X</td> <td>WO, A1, 9106594 (BOWERS FRANK) 16 May 1991, see claims 1-3, 5, 10-11  --</td> <td style="text-align: center; vertical-align: top;">1-2, 4-5, 8, 11</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">X</td> <td>US, A, 4107100 (JOSEF PETERHANS ET AL) 15 August 1978, see column 2, line 30 - line 64; column 3, line 40 - line 54; column 6, line 3 - line 8; abstract; claims 1-5  --</td> <td style="text-align: center; vertical-align: top;">1-5, 8, 11, 12</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>EP, A1, 0165895 (ALBERT FATIO) 27 December 1985, see the whole document  --</td> <td style="text-align: center; vertical-align: top;">1-13</td> </tr> </tbody> </table>			Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	P,X	WO, A1, 9106594 (BOWERS FRANK) 16 May 1991, see claims 1-3, 5, 10-11  --	1-2, 4-5, 8, 11	X	US, A, 4107100 (JOSEF PETERHANS ET AL) 15 August 1978, see column 2, line 30 - line 64; column 3, line 40 - line 54; column 6, line 3 - line 8; abstract; claims 1-5  --	1-5, 8, 11, 12	A	EP, A1, 0165895 (ALBERT FATIO) 27 December 1985, see the whole document  --	1-13
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>* Special categories of cited documents: <sup>10</sup></b></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"G" document member of the same patent family</p> </div> </div>														
<b>IV. CERTIFICATION</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border: none;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">20th July 1992</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">04 AUG 1992</td> </tr> <tr> <td style="border: none;">International Searching Authority</td> <td style="border: none;">Signature of Authorized Officer</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px; text-align: center;">EUROPEAN PATENT OFFICE</td> <td style="border: 1px solid black; padding: 5px;">D. JARVMAN</td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	20th July 1992	04 AUG 1992	International Searching Authority	Signature of Authorized Officer	EUROPEAN PATENT OFFICE	D. JARVMAN				
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		Relevant to Claim No
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	
A	DE, B, 1658488 (A. KOHL & SÖHNE) 23 March 1972, see the whole document  --	1-13
A	DE, A, 2110327 (HERBERT ALLWELT) 21 September 1972, see the whole document  --  -----	1-13